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Contributions to a revision of the genus *Cercidospora* (*Dothideales*) 1. Species on *Megasporaceae*

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Abstract — A study on the taxonomy, morphology and anatomy of lichenicolous species of the genus *Cercidospora* (*Dothideales*, incertae sedis) growing on lichen species of the genera *Aspicilia*, *Lobothallia* and *Megaspora* (*Megasporaceae*) is presented. The following species are proposed as new to science: *Cercidospora galligena* on *Aspicilia caesiocinerea*; *C. solearispora* on *Aspicilia intermutans*, *A. cinerea*, *A. cupreoglauca*, and sterile *Aspicilia* sp.; and *C. werneri* on *Aspicilia calcarea*, *A. contorta,* and *A. desertorum*. A neotype is chosen for *Microthelia verrucosaria*. A key to *Cercidospora* species on megasporacean hosts is provided.

Key words — *Ascomycota*, lichenicolous fungi, lichenized fungi

Introduction

This study is the first contribution to an ongoing revision of the genus *Cercidospora* (*Dothideales*, incertae sedis). It focuses on species growing on lichens of the genera *Aspicilia*, *Lobothallia* and *Megaspora* (*Megasporaceae*, *Pertusariales*; Lumbsch et al. 2004, Lumbsch & Huhndorf 2007). The taxa of these three genera were traditionally included in a wider concept of the genus *Aspicilia* (cf. Ozenda & Clauzade 1970, Clauzade & Roux 1995, Wirth 1980). The only *Cercidospora* species previously known to occur on these genera were *C. verrucosaria*, a parasite of *Megaspora verrucosa* (cf. Arnold 1890, Clauzade et al. 1989, Grube & Hafellner 1990), and the recently described *C. lobothalliae* on *Lobothallia radiosa* (Navarro-Rosinés et al. 2004).

The concept of the genus *Cercidospora* is clearly established in Hafellner (1987) and Grube & Hafellner (1990). Hafellner (1987) redefined the genus and separated the species based mainly on variations in ascospore shape and size as well as by different hosts. In Grube & Hafellner (1990), the genus *Cercidospora* is delimited and compared with other mainly hyalodidymo-spored genera, viz. *Didymellopsis* and *Zwackhiomyces*, that included taxa previously included in a wide concept of *Didymella* (Vouaux 1913, Keissler 1930, Clauzade & Roux 1976). Initially, this genus comprised fungi with perithecioid ascomata and characterized by colorless, 1-septate ascospores and clearly persistent interascal filaments (paraphysoids) in the hamathecium. Later, the generic concept was enlarged to include some taxa with pluriseptate ascospores previously referred to *Metasphaeria* (Hafellner 1987) and species with simple ascospores (Navarro-Rosinés et al. 2004).

Separation of the taxa included in *Cercidospora* has been considered variously by different authors. Some authors have recognized only wide species concepts without taking into account the variations in shape and size of the ascomatal structures (Keissler 1930, Santesson 1960) or treated such variations at the infra-specific level (Vouaux 1913). At the present time, however, the revisional works on lichenicolous fungi tend to consider these variations in size and shape of ascomatal structures and their parts as stable characters of speciation that relate to the specificity of these fungi with their respective host lichens (cf. Hafellner 1987, Grube & Hafellner 1990).

Material and methods

For the microscopic study of the morphology and anatomy of the species, sections of ascomata were prepared by hand, and mounted in water or, to increase the contrast, in lactophenol-cotton blue. All measurements of the different structures were made in water. For the illustrations, a drawing tube fitted to the microscope was used. In the size of the ascospores, the values in italics indicate the average value of length and width, the values in brackets are the extreme values, and the remaining values are the extreme values after rejecting 10% of the highest and 10% of the lowest values. The nomenclature of the host species follows Clauzade & Roux (1985, 1987, 1989), Hafellner & Türk (2001) and Nimis (1993), except for some commented exceptions.

General features of the genus *Cercidospora*

Cercidospora Körb. emend. Hafellner
Parerga Lichenologica: 465 (1865) and Herzogia 7: 354 (1987).

Type species: *Cercidospora ulothii* Körb. [syn. *Cercidospora macrospora* (Uloth) Hafellner & Nav.-Ros.].

The genus *Cercidospora* comprises only lichenicolous fungi with ascomata immersed in the host thallus or apothecia. Exceptionally, deformations in form of cecidia in which ascomata are grouped can be observed.

The ascomata are perithecioid (pseudothecia), externally blackish, smooth, ostiolated, variable in size in the different species, and more or less immersed in the host thallus. The peridial wall is usually intensely pigmented near the ostiolum, this pigment being amorphous and variable in color, from blue-green to violet-brown or blackish; in contrast, the basal part of the ascomata is generally colorless, although in some taxa, it may be more or less pigmented. The wall is formed by thin hyphae, with much reduced cells that do not form a clearly prosoplectenchymatic structure, rather recalling the so-called textura intricata (Hawksworth et al. 1983). Between the fungal ascomata and host thallus, a colorless layer formed by cells with a reduced lumen can frequently be observed.

The hamathecium is formed by paraphysoids, the abundance of which is variable in the different taxa. They are filiform, septate, simple or with some anastomoses.

The asci are typically fissitunicate, cylindrical, or cylindrical-clavate, with the endoascus apically slightly thickened and provided with a small ocular chamber. They contain a variable amount of ascospores depending on the different taxa, ranging from 2 to 8 per ascus.

The ascospores are colorless, with one or more transversal septa in most species and simple only in *C. lobothalliae*; their form is oval, ellipsoid or fusiform, heteropolar or not, strongly heteropolar in some taxa. The occurrence of a perispore in the form of a thin gelatinous sheath is characteristic; this character is especially visible in young ascospores.

Diagnostic for the genus are the pigmentation and texture of the peridium, the persistent paraphysoids, the fissitunicate cylindrical asci, and the hyaline ascospores with a thin perispore. Infrageneric variables important for distinguishing species are mainly the color of the peridial pigment, the number of ascospores per ascus, the ascospore shape and number of septa, quantitative characters of all parts of the ascomata and host selection.

The species

Cercidospora galligena Hafellner & Nav.-Ros., **sp. nov.** Fig. 1

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Ascomata perithecioidea, in areolis convexis aut in gallis supra thallum hospitis evolutis immersa. In sectione transversali pseudothecia globosa, (100–)120–190 µm in diametro. Paries ascomatum apicaliter brunnescens vel viridulo-nigrescens, parce incrassatus, basaliter subhyalinus, 10–20 µm crassus. Paraphysoides copiosae, parce ramoso-anastomosantes, 1.5–2 µm in diametro. Asci cylindrico-clavati, 50–75 µm longi et 12–15 µm lati, 6–8-spori. Ascosporae (13.5–)14–19 × 5–6(–7) µm magnae, incoloratae, 1-septatae, ellipsoidales, rectae vel leviter curvatae, utroque apice rotundatae, septo mediano, at septum non aut parum constrictae, cum cellulis superioribus haud multum crassioribus quam cellulae inferiores.

Cercidosporae verrucosariae *affinis, sed eae dissimilis praesertim ascis brevioribus et latioribus, et ascosporis ellipsoidalibus cum apicibus late rotundatis. Supra thallos Aspiciliae caesiocinereae et specierum aliarum vigens.*

Typus: Spain, Catalonia, prov. Girona: Nuria N von Ribes de Freser, NE von der Bergstation der Zahnradbahn, ca. 2100–2200 m, Südhänge mit subalpinen Rasen und Kalkschieferschrofer, 27.V.1990, J. Hafellner 17371 (GZU- holotypus).

Host species of the type: *Aspicilia caesiocinerea* (Nyl. ex Malbr.) Arnold.

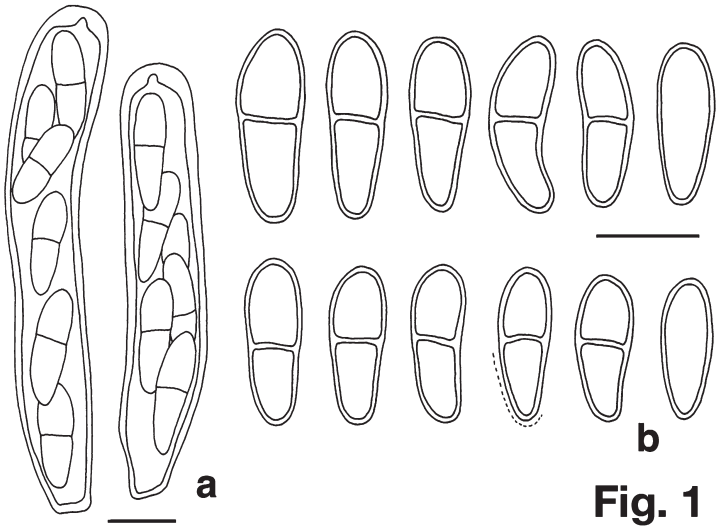
Etymology: From *galligena* (Lat.), inducing the formation of cecidia (galls).

Description — Fungus cecidiogenous, producing convex areoles or small cecidia on the host thallus. Ascomata grouped in cecidia, perithecioid, (100–)120–190 µm diam.; exciple from dark brown to violet-black in the upper part and around the ostiole, colorless in its lower half, and there 10–20 µm thick. Paraphysoids abundant, 1.5–2 µm wide. Asci 50–75 × 12–15 µm, cylindrical-clavate, (4–)6–8-spored. Ascospores (13.5–)14–*16.3*–19 × 5–*5.7*–6(–7) µm, with a length/breadth ratio of (2.0–)2.5–*2.8*–3.2(–3.5) (n = 45), 1-septate, but sometimes some simple ascospores also present, oval-ellipsoid or ellipsoid, slightly heteropolar, with the lower cell only slightly attenuated toward its apex, both apices rounded, septum centered, not or slightly curved.

Remarks — *Cercidospora galligena* shows ascospore sizes similar to those of *C. verrucosaria*, a fungus occurring on *Megaspora verrucosa*. Besides the different host species, these two taxa differ in ascus size, ascospore shape, and in either the production or the lack of cecidia on the host thallus. The asci of *C. verrucosaria* are typically cylindrical, with 65–95(–105) × (8–)9–11 µm, longer and narrower than those of *C. galligena*. The ascospores of *C. verrucosaria* are ellipsoid-fusiform, not oval-ellipsoid as in *C. galligena*. With regard to the cecidiogenous capacity of these species, *C. verrucosaria*, contrary to *C. galligena*, does not induce the formation of cecidia on the host thallus.

Distribution and habitat — *Cercidospora galligena* is currently known only from a few scattered localities in some European countries, namely Spain (Catalonian Pyrénées and Sierra Nevada), Austria, and Sweden, from where it was already reported prior to its valid publication (Santesson 1993). Furthermore we saw a specimen from Greenland. It has been collected on thalli of *Aspicilia caesiocinerea*, *A. grisea*, *A. simoensis*, and unnamed *Aspicilia* species.

Additional specimens examined—**Europe**: **Austria**: Kärnten, Nationalpark Hohe Tauern, Schober-Gruppe, Klammer Scharte zwischen dem hintersten Gössnitzbal und dem hintersten Gradental, 2930 m, GF 9042/2, Gneisfelsen, 9.VII.1988, J. Hafellner & M. Walter (GZU, herb. J. Hafellner 21841). On *Aspicilia grisea.* – Salzburg, Nationalpark Hohe Tauern, Glockner Gruppe, NW-Grat des Grossen Magrötzen Kopfs W ober dem Hochtor, knapp NE unter dem Grat, [47°05'10"N / 12°50'10"E], c. 2620 m, GF 8943/1, Granatglimmerschiefer, auf NE-exponierten Schrofen und Blöcken, 5.VIII.1996, J. Hafellner & H. Wittmann (herb. Hafellner 38187). On *Aspicilia simoensis*. – Tirol,



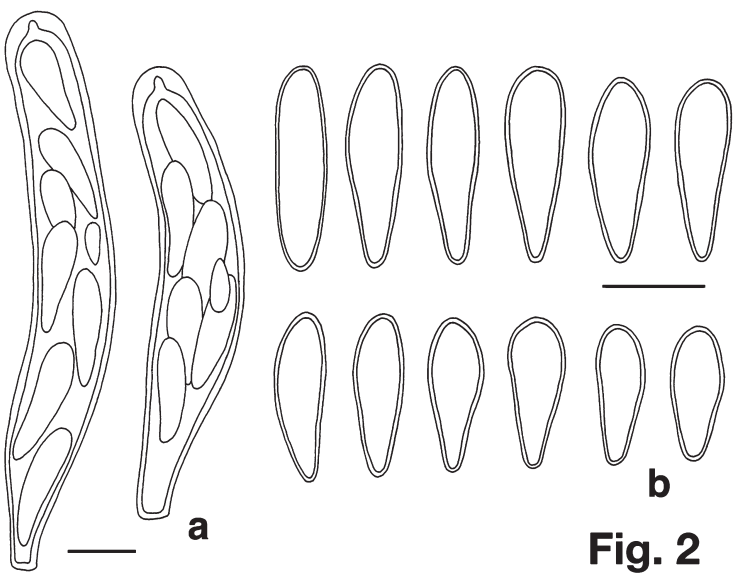


Fig. 1. *Cercidospora galligena* (holotype). a, asci; b, ascospores.

Fig. 2. *Cercidospora lobothalliae* (holotype). a, asci; b, ascospores.
All scales: 10 μm.

Rhätische Alpen, Samnaun-Gruppe, S-seitige Abbrüche der Hänge SE unterhalb Serfaus, 1100–1400 m, Kalkschiefer, sehr trocken, IX.1972, J. Poelt (GZU). On *Aspicilia* sp. – **Spain**: Andalucía, prov. Granada, sur schistes dans la Sierra Nevada, au lieu-dit Valle del Infierno, 2600 m, 7.VI.1934, R.G. Werner (BC, Herb. Werner). On *Aspicilia caesiocinerea* [mentioned as *A. recedens* in Werner 1937]. – **Sweden**: Göteborg, Lilla Änggården, 4.X.1957, A. H. Magnusson 25144 (UPS, GZU). On *Aspicilia* sp. – Bohuslän, Lysekil commune, Skaftö par., Islandsberg, c. 1 km S of Grundsund, on trail to Islandsbergs Huvud, c. 50 m alt., open heathland with gneiss outcrops, on exposed rock faces, 29.VIII.1992, J. Hafellner 30510 (herb. Hafellner). On *Aspicilia* sp. – **North America: Greenland**: W-Grönland, Disko, Umgebung von Godhavn, Unteres Bläsedal NE Godhavn, 50–100 m, 29.VII.1982, J. Poelt & H. Ullrich (GZU). On *Aspicilia* sp.

Cercidospora lobothalliae Nav.-Ros. & Calat., Lichen Flora of the Greater Sonoran Desert Region 2: 637 (2004). Fig. 2

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Typus: Spain: Catalonia, prov. Tarragona, Baix Ebre, Roquetes, Barranc de la Caramella, U.T.M. 31TBF7920-7919, 400–500 m, 19.X.1986, M. Boqueras & P. Navarro-Rosinés (BCC-Lich. holotypus).

Host species of the type: *Lobothallia radiosa* (Hoffm.) Hafellner.

Description — Ascomata perithecioid, 120–160(–200) µm diam.; exciple in the upper part blue-green, basally colorless, *c.* 10 µm thick. Paraphysoids relatively abundant, 1.5–2(–2.5) µm wide. Asci (50–)60–80 × (10–)12–13 µm, cylindrical-clavate, with (4–6–)8 ascospores. Ascospores (13–)16–*18.5*–21.5 (–24) × (4.5–)5–*5.4*–6 µm, with a length/breadth ratio of (2.4–)2.9–*3.4*–4.1(–4.8) (n = 48), simple, colorless, ellipsoid to fusiform, heteropolar, with a narrower lower part, with a thin sheath especially visible in the youngest ascospores, guttulate.

Remarks — *Cercidospora lobothalliae* is characterized among other *Cercidospora* species by its regularly simple ascospores. In other species such as *C. crozalsiana* (Navarro-Rosinés et al. 1995) simple ascospores may also occur, but together with the more abundant 1-septate ones. Another remarkable character of *C. lobothalliae* is the small size of the ascomata, mostly 120–160 µm diam.; they are the smallest of all the species treated here.

Distribution and habitat — *Cercidospora lobothalliae* is known from Mediterranean Europe (eastern Spain and Crete), arctic Asia (Russia), and western North America (California), most of the localities having been mentioned by Navarro-Rosinés et al. (2004), and two recently by Zhurbenko (2009). In all cases, the lichenicolous fungus grows as a specific parasymbiont on *Lobothallia* spp., mainly *L. radiosa*. Zhurbenko (2009) added *L. melanaspis* to the list of host taxa.

Exsiccata: None.

Additional specimens examined: See Navarro-Rosinés et al. (2004).

Cercidospora solearispora Calat., Nav.-Ros. & Hafellner, **sp. nov.** Fig. 3

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Ascomata perithecioidea, immersa in thallis hospitis. In sectione transversali pseudothecia globosa, 160–230 µm in diametro. Paries ascomatum apicaliter viridulo-caerulescens, parce incrassatus, basaliter subhyalinus, 11–18 µm crassus. Paraphysoides copiosae, 1–1.5 µm in diametro. Asci cylindrico-clavati, circa 50–70 µm longi et 10–15 µm lati, (6–)8-spori. Ascosporae (15–)17–21(–22) × (4.5–)5–6(–7) µm magnae, incoloratae, uniseptatae, rariore simplices, fusiformes vel anguste soleiformes, cellulis inaequalibus, cellula inferiore atenuata, distincte breviore angustioreque quam cellula superior, ad septum non aut parum constrictae.

Cercidosporae verrucosariae *affinis, sed eae dissimilis ascosporibus soleiformibus. Supra thallum* Aspiciliae intermutantis *et specierum aliarum vigens.*

Typus: Spain, Comunidad Valenciana, prov. de Castelló, Alfondeguilla, Pico Nevera, U.T.M. 30SYK3115, 740 m, 10.VI.1989, V. Calatayud (VAB-lich. 1982 holotypus).

Host species of the type: *Aspicilia intermutans* (Nyl.) Arnold.

Etymology: From *solearis*, *-e*, adj. (Lat.) [from *solea*, *-ae*, subst., sole, sandal], something which has the shape of a sandal (Blanquez 1946) and *spora*, *-ae* subst. (Lat.), spore, in this case meaning ascospore; referring to the sole-shape of the ascospores in optical section view.

? Syn.: *Didymella ulothii* var. *apiosporoides* Vouaux, in Bouly de Lesdain, Bull. Soc. Bot. France 56: 175 (1909). Typus: France, Puy-de-Dôme, Puy-Crouel, leg. Brevière (?) [n. v.]. Host: "sur thalle stérile saxicole" (Bouly de Lesdain 1909: 175, Vouaux 1913: 90).

≡ *Didymella epipolytropa* var. *apiosporoides* (Vouaux) Vouaux, Bull. Soc. Mycol. France 29: 90 (1913).

Description — Fungus cecidiogenous only in some cases (on *A. cinerea*), producing small cecidia on the host thallus. Ascomata perithecioid, 160–230 µm diam., globose; lower half of exciple colorless, blue-green around the ostiole, 11–18 µm thick towards the lower part of the ascomata. Paraphysoids abundant, 1.5–2 µm wide. Asci 50–70 × 10–15 µm, cylindrical-clavate, (6–)8-spored. Ascospores (15–)17–*18.8*–21(–22) × (4.5–)5–*5.4*–6(–7) µm, with a length/breadth ratio of (2.6–)3.0–*3.5*–4.2(–4.8) ($n = 93$), 1-septate, or occasionally also simple, between narrowly fusiform and soleiform, with the two cells markedly heteropolar, with a very different shape and size, lower cell much shorter and narrower than the upper one, with only 1/3 to 1/4 of the overall length of the spore.

Remarks — *Cercidospora solearispora* is easily separated from the rest of species growing on *Aspicilia* s.l. The marked heteropolarity of the ascospores, with the lower cell much shorter and narrower than the upper one, is diagnostic. Ascospores with a similar shape occur in some specimens of *Cercidospora* growing on different *Caloplaca* species, but in them, the lower cell is more acute and somewhat larger than in *C. solearispora*. Such *Cercidospora* specimens on *Caloplaca* will be treated in a forthcoming contribution to the revision of this genus, devoted to the species associated with taxa on the *Teloschistales*.

Didymella ulothii var. *apiosporoides* is possibly a synonym of this taxon. According to Vouaux (Bouly de Lesdain 1909: 175; Vouaux 1913: 90), this variety grows "sur thalle stérile saxicole", which could well be a sterile *Aspicilia* thallus. The ascospore size given by Vouaux (1913), 16–20 × 6–7 µm, is very similar to that of *C. solearispora*. However, Vouaux stated that in the ascospores, "leur extrémite inférieure est si nettement allongée en forme de queue, ...", implying that the lower cell is narrower than the upper one. Unfortunately, the length ratio between both cells — regarded as diagnostic for identification of *C. solearispora* — is not given in the description by Vouaux (1913). There is no specimen of *Didymella ulothii* var. *apiosporoides* among the remnants of the Vouaux herbarium (Rondon 1969), and the herbarium of Bouly de Lesdain was destroyed during World War Two (Grummann 1974). As the application of the name is not entirely clear, it has not been taken up by us.

Distribution and habitat — *Cercidospora solearispora* is a relatively abundant species known from different localities in Austria, the Czech Republic (Kocourková 2000, Vondrák et al. 2007), France, Spain, and Turkey (Halıcı et al 2007). It grows on *Aspicilia* species, mostly reacting K+ red in the thallus and on strains of the *Aspicilia caesiocinerea* complex. Among the species containing norstictic acid, we could identify *A. cinerea*, *A. cupreoglauca,* and *A. intermutans*. However, in many of the specimens examined, a reliable identification of the host was not possible as the material is sterile or belongs to taxonomically unresolved species complexes within *Aspicilia*. In a number of cases the infection with a lichenicolous fungus may have contributed to inhibit apothecium development of the host lichen, which is an unusual fact in *Cercidospora*. Other hosts mentioned for this species include *Aspicilia contorta* (fide Kocourková 2000), *A. contorta* subsp. *hoffmanniana* (fide Vondrák et al. 2007) and a sterile grey crustose lichen (fide Halıcı et al 2007).

Exsiccata—none.

Additional specimens studied—**Austria**: Kärnten, Gurktaler Alpen, Nockgebiet, N von Radenthein, Langalmtal, knapp S der Veidlhütte, WNW der Schartenalm, auf Silikatfels in Ufernähe des Rossbaches, 1380 m, GF 9148/1, 23.IX.1988, H. Wittmann (GZU). On *Aspicilia caesiocinerea* coll. – Steiermark, [Seetalerer Alpen], ca. 2 km NW von Neumarkt, beim Gasthof Vetterl, ca. 900 m, GF 8952/1, niedrige phyllitische Felsblöcke auf einer Viehweide, 13.IX.1987, W. Obermayer 1935 (GZU). On *Aspicilia cinerea*. – Steiermark, W-Abhang der Seetaler Alpen, 5 km E von Neumarkt, Oberberg, 200 m unter dem Gehöft Schweintaler, 1250 m, GF 9852/2, offene Waldweide, Felsblöcke, 20.III.1987, W. Obermayer 1934 (GZU). On *Aspicilia* sp. – Oberösterreich, Donautal, Schlögener Schlinge, Steiner Fels, 380 m, GF 7549, auf silikatischen Felsen, 24.XII.1995, F. Berger 9514 (GZU). On *Aspicilia caesiocinerea* coll. – **Czech Republik**: Bohemia centralis, Beroun, regio protecta Křivoklátsko, vicum Stará Ves prope pagum Hudlice, in rupibus diabasicis, alt. 340 m, GF 6049, 10. XI.1996, J. Horáková & P. Kocourek (GZU). On *Aspicilia* sp. – **France**: Lozère, Cévennes, la Roquette, N von le Pompidou, W von Alès, 670 m, S-exponierte Gneisabbrüche, G. Clauzade, C. Roux & J. Hafellner (herb. Hafellner 21951). On *Aspicilia* cf. *cinerea* (sterile). – **Italy**: Sardinien, Prov. Cagliari, Porto

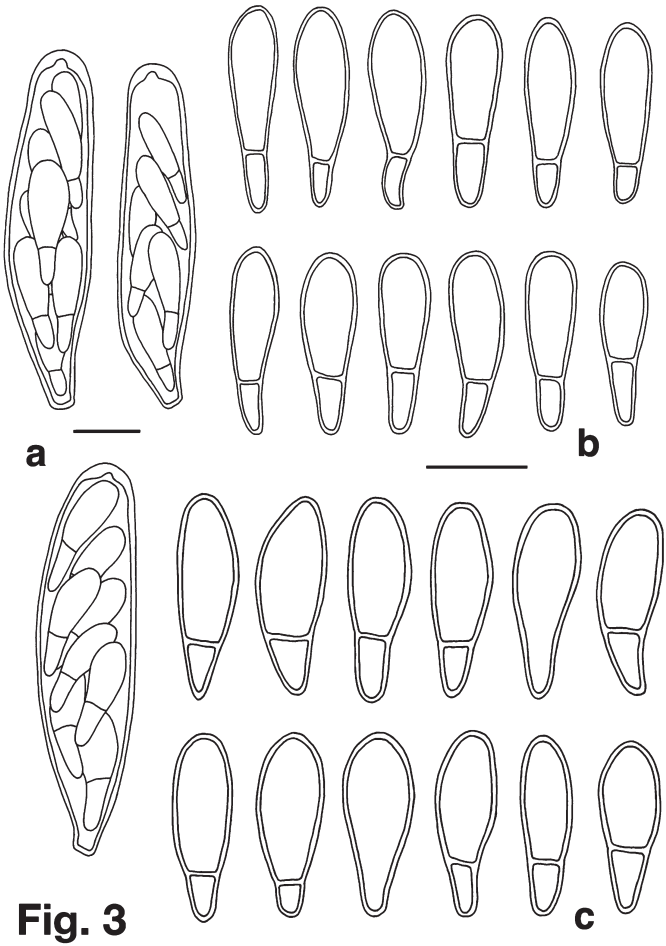

Fig. 3. *Cercidospora solearispora* (a, b, Créixer, Catalonia, Spain; c, holotype). a, asci; b, c, ascospores. All scales: 10 µm.

S. Stefano nahe Capo Carbonara, 2–4 m alt., Küstenfelsen, 17.VII.1985, J. Poelt (GZU). On *Aspicilia calcarea* coll. – Sardinien, Prov. Cagliari, Tal des Rio Giutturu Mannu, NW-exponierte Quarzit-Wand nahe der Kreuzung Ciri Fiddi, um 90 m, 18.VII.1985, P. L. Nimis & J. Poelt (GZU). On *Aspicilia* sp. – Valle d'Aosta, Castello di Chatelard (La Salle), ca. 1100 m alt., 29.X.1973, A. Buschardt (herb. Hafellner 10110). On *Aspicilia* sp. – **Slovenia**: Central Alps, Kobansko, Koralpe, mountain top ("Jantschkifels") 7,6 km NE above Dravograd (Unterdrauburg) (W above the chapel Sv. Urban), uppermost slopes exposed to S just below the summit close to the border to Austria, 46°39'08"N / 15°03'49"E, ca. 1360 m, scattered boulders of garnet schist on clearings in the spruce forest, on inclined rock faces of the boulders, 20.VII.2008, J. Hafellner no. 72607 (herb. Hafellner). On *Aspicilia cinerea* (th.). – **Spain, Catalonia**: Prov. Girona, Alt Empordà,

Vilajuïga, Castell de Carmençó, U.T.M. 31TEG0787, 100 m, P. Navarro-Rosinés, X. Llimona & C. Roux, 7.III.1992 (BCC-lich.). On *Aspicilia cupreoglauca*. – Prov. Girona, Baixa Cerdanya, Crèixer, cerca del pueblo U.T.M. 31TDG0396, 1400 m, X. Llimona & J.M. Pérez-Redondo, 30.XI.1990 (BCC-lich.). On *Aspicilia cinerea*. – Prov. Girona, Baixa Cerdanya, Meranges, prado cerca de Guirult, U.T.M. 31TCH9900, 1600 m, X. Llimona & J.M. Pérez-Redondo, 17.IV.1992 (BCC-lich.). On *Aspicilia* sp. (K-, st.). – **Comunidad Valenciana**: prov. de Valencia, Puçol, el Picaio, U.T.M. 30SYJ3091, arenisca, 350 m, 26.II.1992, V. Calatayud (VAB-lich. 7875). On *Aspicilia intermutans*.

Cercidospora verrucosaria (Linds.) Arnold, Flora 57: 154 (1874) Fig. 4

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Bas.: *Microthelia verrucosaria* Linds., Quart. J. Microsc. Sci. 9: 349 (1869).

≡ *Arthopyrenia verrucosaria* (Linds.) Arnold, Flora 57: 139 (1874).

≡ *Didymella verrucosaria* (Linds.) Sacc. & D. Sacc., Syll. Fung. 17: 657 (1905).

≡ *Didymosphaeria verrucosaria* (Linds.) Magnus, in Dalla Torre & Sarnthein, Flora von Tirol 3: 473 (1905).

Typus: Great Britain, Scotland, Craig-na-Galliach and Ben Lawers, leg. Maingay, E- (n. v., see remark below). – Austria: Styria, Eastern Alps, Niedere Tauern, Wölzer Tauern, Rettlkirchspitze NW of the little town Oberwölz, slope exposed to the N c. 1 km W of the refuge Neunkirchner Hütte, 47°16'15"N / 14°08'00"E, c. 1720 m alt., GF 8750/2, marble outcrops in subalpine pasture, on plant remnants, 24. VIII. 2002, J. Hafellner (60688) & J. Miadlikowska = Hafellner, Lichenicolous Biota 33 (GZU, neotypus; BR, CANB, NY, UPS, isoneotypi).

Host species of the type: *Megaspora verrucosa* (Ach.) Hafellner & V. Wirth.

Illustrations: Vězda (1970: 223, fig 2).

Description — Ascomata perithecioid, 130–200(–300) µm diam., globose; exciple colorless in its lower half part and dark bluish brown around the ostiole, 10–15 µm thick towards the base of the ascomata. Paraphysoids relatively abundant, 1.5–2 µm thick. Asci 65–95(–105) × (8–)9–11 µm, elongate subcylindrical, 8-spored, exceptionally only 4-spored. Ascospores (14.5–)15.5–*17.6*–19.5(–23) × (4.5–)5–*5.4*–6(–7) µm, with a length/breadth ratio of (2.1–)2.8–*3.3*–3.8(–4.4) (*n* = 113), 1-septate, but some simple, ellipsoid or fusiform, slightly heteropolar, not constricted at the septum, halonate.

Remarks — The fact that the type of *Cercidospora verrucosaria* could not be found in W.L. Lindsay's herbarium, in Edinburgh (Hawksworth 1985, Hawksworth & Diederich 1988), has complicated the understanding of this taxon. Correct delimitation is further complicated in that the original description by Lindsay (1869), later adopted by Vouaux (1913), does not provide dimensions of the ascospores, which are described only as oval-oblong and 8 per ascus. We have selected a neotype in order to stabilize the name.

Fortunately, *Cercidospora verrucosaria* is a relatively abundant taxon and examination of numerous specimens has allowed us to study character variations to compare with other taxa; as a conclusion, it is regarded here as

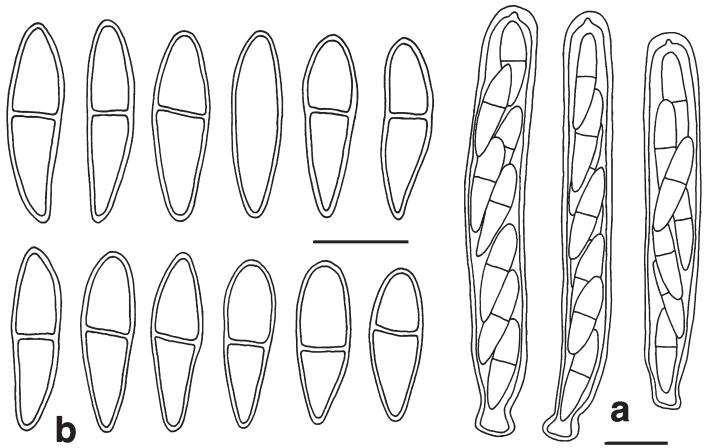

Fig. 4

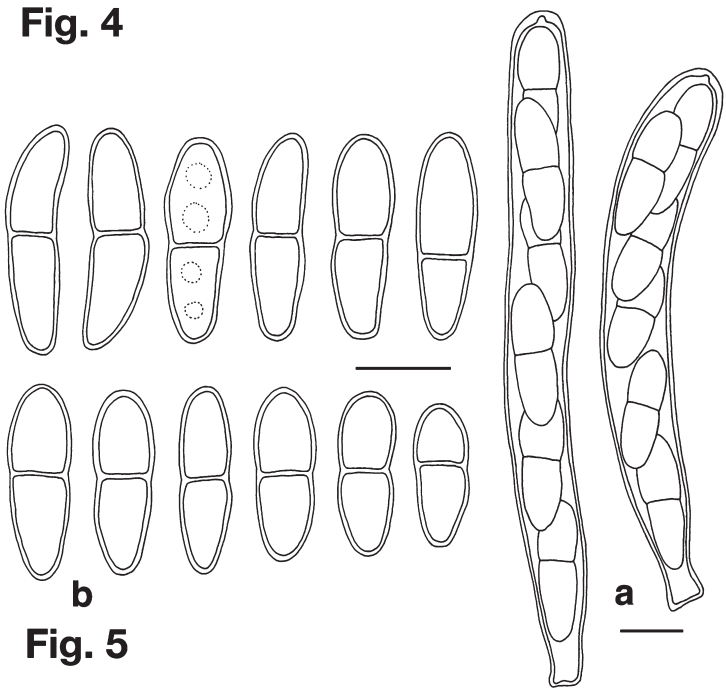

Fig. 5

Fig. 4. *Cercidospora verrucosaria* (Urús, Catalonia, Spain).
a, asci; b, ascospores.

Fig. 5. *Cercidospora mutabilicola* ined. (Puebla de San Miguel, Comunitat Valenciana).
a, asci; b, ascospores.
All scales: 10 μm.

a specific parasite of *Megaspora verrucosa*. *C. verrucosaria* is characterized by ± constantly 8-spored asci and 15–19 µm long ascospores. Our observations agree with data cited by Arnold (1890) but differ slightly from the description of *C. "epipolytropa"* by Vězda (1970), based on specimens growing on *Megaspora verrucosa*. Vězda described *C. "epipolytropa"* as having asci with 4, 6 or 8 spores and ascospores that are much larger (13–30 × 4–8 µm) in both length and width than in our measurements. On the contrary, the spore size reported by Vězda is not reflected in his own illustrations (Vězda 1970: 223, fig 2) that depict all ascospores with a similar size and shape. We suspect that the author included immature ascospores in his measurements.

The above description is based on European samples including the neotype specimen, all growing on muscicolous or terricolous specimens of *Megaspora verrucosa*, on which ascomata can develop on the thallus, along apothecial margins, and even in the hymenia. Sonoran specimens referred to *C. verrucosaria* s.l. grow on the corticolous variety, *Megaspora verrucosa* var. *mutabilis,* and have 4-spored asci (Navarro-Rosinés et al. 2004). European specimens on the same corticolous variety might represent a different entity, mentioned in the literature as *C. mutabilicola* Calat. et al., nom. nud. (Navarro-Rosinés et al. 2004). In this taxon, ascomata and ascospores are larger than in typical specimens growing on *M. verrucosa* var. *verrucosa* (Fig. 5). A short description based on this material (listed at the end) follows: Ascomata perithecioid, 230–350 µm diam., globose; exciple colourless at the base, and violet-brown in the upper half, close to the ostiole, c. 10 µm thick in the lower part of the ascomata. Paraphysoids abundant, (1.5–)2(–2.5) µm wide. Asci 70–110 × 9–13 µm, cylindrical, (4–)6(–8)-spored. Ascospores (15.5–)18–*21.0*–24(–25) × 5–*6*–7 µm, with a lenght/width ratio of (2.4–)2.9–*3.6*–4.2(–5.8) (*n* = 63), 1-septate, ellipsoid, at both ends rounded, not or only slightly heteropolar, not or slightly constricted at the septum, without an apparent sheath. Further studies involving the study of more material of specimens on *M. verrucosa* var. *mutabilis* from different geographic areas are still needed in order to clarify if these specimens merit being considered as a formally separate taxon from *C. verrucosaria* s. str., and to better define the limits between possible different entities.

The morphological characters of *Cercidospora verrucosaria* are close to those of *C. galligena*. For its separation, see the comments given in its description.

Distribution and habitat — *Cercidospora verrucosaria* has been reported from its original locality in Scotland, and from different sites in Europe including Austria (Bilovitz & Mayrhofer 2008, Hafellner 2000, 2002, 2008a, 2008b, Hafellner & Obermayer 2007, Hafellner & Türk 1995, Hafellner & Wittmann 1996, Hafellner et al. 2004, 2005a, 2005b, 2008, Obermayer 1999), Germany (Arnold 1890, Triebel & Scholz 2001), Great Britain (Lindsay 1869), Iceland (Svane & Alstrup 2004), Italy (Arnold 1896, Kernstock 1893),

Norway (Santesson 1993), Russia (Zhurbenko 2002, 2004, 2008, 2009), Sweden (Santesson 1993), Switzerland (Boissière et al. 1989). Outside Europe it is known from the Canary Islands (La Palma, Berger & Etayo 1998), North America (Arizona and Chihuahua, Navarro-Rosinés et al. 2004), and New Zealand (Hafellner & Mayrhofer 2007). Other citations of this species have been included in a wide concept of *C. epipolytropa* (cf. Vězda 1970, from Slovakia). It grows as a parasymbiont on *Megaspora verrucosa*, a muscicolous or terricolous lichen, dwelling mainly in alpine and subalpine vegetation belts of high mountain ranges.

Exsiccata—Hafellner, Lichenicolous Biota 33 (BR, CANB, GZU, NY, UPS); Obermayer, Dupla Graecensia Lichenum 46 (BC, CANB, GZU, M, NY, UPS).

Selected specimens examined (including only a geographically representative selection cited; all specimens growing in thalli and apothecia of *Megaspora verrucosa*)—**Europe: Austria**: Niederösterreich, Nördliche Kalkalpen, Schneeberg NW von Neunkirchen, Kaiserstein, knapp E unter dem Gipfel am Südrand der Abbrüche in die Breite Ries, 47°46'25"N / 15°48'45"E, ca. 2000 m, GF 8260/2, Rasentreppen mit kleinen Kalkschrofen auf Moosen und Pflanzenresten, 29.VI.1997, J. Hafellner 42244 (GZU). – Steiermark, Dachstein-Gruppe, Gipfel des Stoderzinkens [N von Gröbming], windgefegte Rasen auf der Nordseite, ca. 2050 m alt., 29.VII.1976, J. Hafellner 1849 (GZU). – Steiermark, Nördliche Kalkalpen, Totes Gebirge, Tauplitzalm-Gebiet NE von Bad Mitterndorf, Bartlrücken N ober dem Steirersee, 47°37'25"N / 14°01'55"E, ca. 2130 m, GF 8350/3, Windkanten im Gipfelbereich, Caricetum firmae, auf Pflanzenresten, 4.VII.1999, J. Hafellner 48906 (GZU). – Steiermark, Nördliche Kalkalpen, Ennstaler Alpen, Haller Mauern N von Admont, Hexenturm, im Gipfelbereich, 47°38'47"N / 14°28'55"E, ca. 2170 m, GF 8352/4, Kalkschrofen mit lückiger alpiner Vegetation, S-exponiert auf Moosen und Pflanzenresten, 9.IX.2006, J. Hafellner 67213 (GZU). – Steiermark, Nördliche Kalkalpen, Ennstaler Alpen, Gesäuseberge, Hochzinödl ca. 6,5 km SW von Hieflau, NE über der Hess-Hütte, etwas SW unterhalb vom Gipfel, 47°33'58"N / 14°40'01"E, ca. 2185 m, GF 8454/1, mit Rasenbändern durchsetzte Felsausbisse aus Triaskalk, in erdgefüllten Felsspalten, 20.V.2007, J. Hafellner 68610, L. Muggia & A. Hafellner (GZU). – Steiermark, Eisenerzer Alpen, Zeiritzkampel N von Kalwang, im Gratbereich kurz E vom Gipfel, 47°29'30"N / 14°43'45"E, ca. 2100 m, GF 8554/1, alpine Matten über paläozoischem Kalk, N-seitig auf Moosen und Pflanzenresten, 29.VIII.1997, J. Hafellner 43161 & A. Hafellner (GZU). – Steiermark, Nördliche Kalkalpen, Hochschwab-Gruppe, Brandstein ca. 9,5 km NE von Eisenerz, kurz N unter dem Gipfel, 47°36'05"N / 14°59'00"E, ca. 1990 m, GF 8355/4, Kalkschrofen am oberen Rand der E-exponierten Abbrüche, auf Moosen und Pflanzenresten, 5.VIII.2004, Hafellner 63386 (GZU). – Steiermark, Nördliche Kalkalpen, Mürzsteger Alpen, Veitsch Alpe, Grosser Wildkamm, am SE-Grat ober der Gingatzwiese, 47°39'40"N / 15°24'30"E, ca. 1850 m, GF 8358/1, Kalkschrofen mit Caricetum firmae-Fragmenten, auf Moosen und Pflanzenresten, 17.V.1997, J. Miadlikowska & J. Hafellner 42632 (GZU). – Steiermark, Niedere Tauern, Schladminger Tauern, Znachsattel S ober der Giglachseehütte S von Schladming, NE-Hänge unmittelbar W ober dem Sattel, 47°16'30"N / 13°38'20"E, ca. 2060 m, GF 8747/2, *Dryas*-reiche Rasen über Kalk, auf Moosen und Pflanzenresten, 27.VIII.2001, J. Hafellner 56649 (GZU). – Steiermark, Niedere Tauern, Wölzer Tauern, Gumpeneck SE von Gröbming, Gipfelpyramide, NW-seitig, 47°23'50"N / 14°00'50"E, ca. 2180 m, GF 8650/1, Marmor, auf Moosen und Pflanzenresten, 10.VI.1993, J. Hafellner 49852 & A. Wilfling (GZU). –Steiermark, Niedere Tauern, Triebener Tauern, Griesmoar Kogel SW von Wald am Schoberpass, im

oberen Teil des E-Rückens, 47°25'05"N / 14°36'20"E, ca. 1920 m, GF 8553/4, S-exponierte Schrofen auf leicht karbonathältigem Grünschiefer, über Moosen und Pflanzenresten, 14.VII.2001, J. Hafellner 56083 (GZU). – Steiermark, Gurktaler Alpen, N unter der Stang Scharte (zwischen Stang Nock und Gregerl Nock), [46°55'55"N / 13°48'10"E], ca. 2020 m, GF 9048/4, subalpine Zwergstrauchheiden mit einzelnen grossen Felsblöcken, auf Pflanzenresten, 15.VIII.1989, J. Hafellner 6404 (GZU). – Steiermark, Steirisches Randgebirge, Stubalpe, Wölkerkogel oberhalb vom Alten Almhaus, direkt im Gipfelbereich, [47°04'50"N / 14°55'30"E], 1670–1706 m, GF 8955/2, grobkristalliner Marmor, auf Moosen und Pflanzenresten, 13.VIII.1993, A. Wilfling 2300, C. Unger & L. Unger (GZU). – Kärnten, Nationalpark Hohe Tauern, Glockner-Gruppe, Hoher Burgstall NW von Heiligenblut, SE der Oberwalder Hütte, 2960 m, GF 8842/3, alpine Rasenfragmente, 20.IX.1988, J. Hafellner, M. Walther & A. Hafellner 28479 (GZU). – Kärnten, Nationalpark Hohe Tauern, Goldberg-Gruppe, Goldberg-Gruppe, Vorderer Gesselkopf, im untersten Teil des Nordgrates W von der Hagener Hütte, ca. 2500 m, GF 8944/3, Kalkschieferschrofen, E-exponiert auf Moosen und Pflanzenresten, 10.VIII.1994, J. Hafellner 33098 (GZU). – Kärnten, [Steirisches Randgebirge], Koralpe, Grosses Kar N vom Grossen Speikkogel, ober dem markierten Weg zum Schäferkreuz, [46°47'40"N / 14°58'40"E], ca. 1950 m, GF 9255/2, W-exponierte Abbrüche von Marmorschrofen, auf Moosen, 19.IX.1993, A. Wilfling 1744, 1832 (GZU). – Kärnten, Karawanken, Hochobir-Massiv NE von Eisenkappel, am Südgrat knapp unter dem Gipfel, 46°30'15"N / 14°29'15"E, ca. 2100 m, GF 9452/4, niedere Kalkschrofen am Rand der westseitigen Abbrüche, auf Pflanzenresten, 16.VII.1998, J. Hafellner 45667 (GZU). – Salzburg, Hohe Tauern, Glockner-Gruppe, Bergkamm NW vom Kitzsteinhorn, ca. 2 km W ober der Krefelder Hütte, S-Grat der Hinteren Rettenwand, [47°12'40"N / 12°40'45"E], ca. 2680 m, GF 8742/3, Kalkschiefer, auf Moosen und Pflanzenresten, 20.VII.1996, J. Hafellner 38207 & H. Wittmann (GZU). – Salzburg, Nationalpark Hohe Tauern, Goldberggruppe, Vorderer Gesselkopf (Geisslkopf), am Westgrat knapp unter dem Gipfel, [47°00'50"N / 13°04'20"E], ca. 2950 m, GF 8944/3, kalkhältige Glimmerschieferblöcke auf einem steilen Westhang, auf Moosen und Pflanzenresten, 10.VIII.1994, J. Hafellner 33247 (GZU). – Salzburg, Nationalpark Hohe Tauern, Ankogel Gruppe, knapp N unter dem Westgrat des Greilkopf E ober der Hagener Hütte, [47°01'40"N / 13°05'40"E], ca. 2440 m, GF 8944/4, alpine Matten über Kalkschiefer, auf Pflanzenresten, 27.VIII.1994, J. Hafellner 33044 (GZU). – Salzburg, Radstädter Tauern, Salzburg, Lungau, Umgebung von Mauterndorf, Trogalm zwischen Speiereck und Grosseck, südseitige Abbrüche, Mergelkalk mit Kieselkalklinsen, 2000–2100 m alt., 7.IX.1981, J. Hafellner 9344 (GZU). – Tirol, Osttirol, Nationalpark Hohe Tauern, Glockner-Gruppe, Teischnitztal N von Kals, untere NW-Hänge des Fiegerhorns, SW ober der Teischnitzeben, 47°02'N / 12°39'40"E, ca. 2200 m, GF 8941/4, alpine Matten, auf Moosen und Pflanzenresten über Kalkschiefer, 16.VII.1997, J. Hafellner 46926 (GZU). – **France**: Alta Savoia, Vallorcine, Parc Vieux, a 1,5 km W del Col de Balme, 2100 m, roca calcària, a 0,8 m de sòl, orient SW, incl. 10°, 30.VIII.1988, P. Navarro-Rosinés (BCC-lich. 13279). – **Germany**: Bayern, Allgäuer Alpen, Aggenstein, Aufstieg über den "Schrägen Strich" auf der N-Seite, 1880 m, auf abgestorbener *Carex firma*, 17.X.1951, A. Schröppel & H. Doppelbaur (GZU). – **Italy**: Trentino-Alto Adige, prov. Bolzano (Südtirol), Southern Alps, Dolomiti, M. Seceda (Geisler Spitzen) NE of Ortisei (St. Ulrich), on the ridge just W above Forc Pana (Pana Scharte), 46°36'05"N / 11°44'05"E, ca. 2500 m, low outcrops of limestone in alpine vegetation, on bryophytes and plant debris, 2.IX.2002, J. Hafellner 61216 (GZU). – [prov. Trento], Südtiroler Dolomiten, Marmolada, N-Hänge ober Pian Trevisan, W ober dem Fedaia-Pass, 2240 m, über Moosen und Pflanzenresten, 13.IV.1981, J. Hafellner 9083 (GZU). – **Slovenia**: Julische Alpen, Mangart E vom Predilpass, Steig von der Lahnscharte zum Gipfel des Mangart, ca. 2100 m, auf Pflanzenresten, 21.VII.1979, M.Mayrhofer & H.Mayrhofer

(GZU). – Mangart in den Julischen Alpen, 1873, J. Glowacki (GZU). – **Spain**: Catalonia, prov. Girona, la Cerdanya, Urús, les Suquetes (Moixeró), UTM 31TDG0685, 2140 m alt. sobre *Saxifraga oppositifolia* subsp. *marithiana*, 11.VII.1985, N.L. Hladun (BCC-lich.). – **Switzerland**: Kanton Graubünden, Albula Alpen, Albulapass, W-exponierte Hänge des Piz Uertsch W der Passhöhe, 2400 m, Kalk, auf Pflanzenresten, 26.VIII.1979, H. Mayrhofer 16313 (GZU). – **Asia: Nepal**: Central Himalaya, Langtang, above Karka Sarwa, upper alpine belt, 5080 m s. m., scree exposed to the S, on dead mosses covering boulders, 22.IX.1986, G. Miehe no. 12688a & S. Miehe (GZU). – **Australasia: New Zealand**: South Island, Canterbury: Mt. Peel, summit, 43°51'S / 171°09'30"E, 1700–1744 m s. m., 16.I.1985, H. Mayrhofer no. 16240, H. Hertel, C.D. Meurk & B.P.J. Molloy (GZU).

Specimens of *Cercidospora mutabilicola* ined. examined (all specimens growing on thalli of *Megaspora verrucosa* var. *mutabilis*): **Europe**: **Italy**: Basilicata, prov. Potenza, N-Abhänge des Monte Pollino, Piana dell Pollino NW Serra delle Ciavole, ca. 1900 m, Weiden und Felskuppen, dazwischen einzelne alte *Pinus leucodermis*, an der Stammbasis von *Pinus leucodermis*, 2.VI.1979, H. Mayrhofer (GZU). – **Spain**: Comunitat Valenciana, prov. València, Puebla de San Miguel, La Canaleja, U.T.M. 30SXK6037, sobre *Juniperus thurifera*, 1440 m, 1.VII.1993, V. Calatayud, V. Atienza & S. Fos (VAB-lich. 7295). – **Switzerland**: In m. Stockhorn (GZU, Schaer, Lich. Helv. exs. 134). – **Asia**: **Cyprus**: Distr. Limassol, Troodos, Gipfel des Mt. Olympus, 1930–1951 m, Felsblöcke, lockere *Pinus nigra* subsp. *pallasiana* und *Juniperus foetidissima* Bestände, auf Borke von *Juniperus foetidissima*, 15.IV.1987, M. Mayrhofer & H. Mayrhofer 16312 (GZU)

Cercidospora werneri Nav.-Ros., Calat. & Hafellner, **sp. nov.** Fig. 6

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Ascomata perithecioidea, immersa in apotheciis hospitis. In sectione transversali pseudothecia globosa, 150–260 µm in diametro. Paries ascomatum apicaliter viridulo-caerulescens, parce incrassatus, basaliter subhyalinus, 10–25 µm crassus. Paraphysoides ± copiosae, simplices vel leviter ramoso-anastomosantes, 1–1.5 µm in diametro. Asci cylindrici, circa 70–100 µm longi et 8–11 µm lati, plerumque tetraspori. Ascosporae (18–) 22–31(–34.5) × (4.5–)5–6(–7) µm magnae, incoloratae, fusiformes, 1(–3)-septatae, cellulis aequalibus aut aliquot inaequalibus, cum cellula inferiore apicaliter atenuata, longioreque quam cellula superior, ad septum non aut parum constrictae, tenuiter halonatae.

Cercidosporae macrosporae *affinis, sed eae dissimilis ascosporibus cellula inferiore apicaliter atenuata. Supra apothecia* Aspiciliae desertorum *et supra thallos specierum aliarum vigens.*

Typus: The Lebanon: sur rochers calcaires au-dessus de Becharré, dans la cédraie et au delà, 2000 m alt., 27.08.1938, leg. R.-G. Werner (BC - Herb. Werner, holotypus) [holotype of *Lecanora (Aspicilia) auricularis* Werner (Werner 1956: 467)].

Host species of the type: *Aspicilia desertorum* (Kremp.) Mereschk.

Etymology: *werneri* (Lat.), belonging to Werner; named after Roger-Guy Werner (1901–1977).

Description — Ascomata perithecioid, 150–260 µm diam.; exciple dark blue-green to slightly brown in the upper half, close to the ostiole, and colorless towards the base, (10–)15–25 µm thick in this part of the ascomata. Paraphysoids relatively abundant, 1–1.5 µm wide. Asci 70–100 × 8–11 µm, cylindrical, (2–)4(–8)-spored. Ascospores (18–)22–*26.1*–31(–34.5) × (4.5–)5–*5.4*–6(–7) µm,

with a length/breadth ratio of (3.3–)4.0–*4.9*–5.9(–6.9) (*n* = 111), 1(–3)-septate, colorless, fusiform, not or ± markedly heteropolar, with the lower cell somewhat attenuate with regard to the upper one, frequently slightly curved, not or only slightly constricted at the septum, guttulate.

Remarks — Among the species treated here, *Cercidospora werneri* has the largest spore size. The ascospores are usually 1-septate, but 3-septate spores may also be observed. In shape and size of ascospores, asci, and ascomata, *C. werneri* recalls *C. crozalsiana*, a lichenicolous fungus reported on different *Squamarina* species (Navarro-Rosinés et al. 1995). In *C. crozalsiana*, contrary to *C. werneri*, triseptate ascospores have never been observed, although simple ascospores may occur with the predominant 1-septate ones.

In the Spanish specimen of *C. werneri*, the ascospores differ slightly from those of the type. The lower cell, narrower and longer than the upper one, is elongated in the form of a tail and recalls *C. caudata* and *C. epicarphinea*, two fungi of different *Caloplaca* species. However, the two mentioned species have 8-spored asci, contrasting with the primarily 4-spored asci found in *C. werneri*.

Werner (1956) cited this new species as *Didymella epipolytropa* var. *ulothii*. However, *C. macrospora* (syn. *C. ulothii*), a fungus associated with species of *Protoparmeliopsis* (i.e. the *Lecanora muralis* group), has somewhat shorter (primarily 20–25 µm long) ascospores and with both cells equal in shape and size, with the septum centered, more rarely slightly heteropolar (Hafellner 1987).

Specimens of *Cercidospora werneri* growing on *A. calcarea* and *A. contorta* are characterized by shorter ascospores than those observed on *A. desertorum*. On the former two hosts, ascospores measure only (18–)20–*22.2*–24.5(–26) × (4.5–)5–*5.2*–5.5(–6) µm, with a length/width ratio of (3.3–)3.5–*4.3*–5.1(–5.6) (*n* = 26), but they are also heteropolar, with their lower cell equally attenuated, and are triseptate in some cases. In all studied specimens of *C. werneri,* the ascospore size is larger that in the other studied species of *Cercidospora* growing on *Megasporaceae*.

Distribution and habitat — *Cercidospora werneri* is known from the type locality in the Lebanon and from Aragón (Spain), growing as a specific parasymbiont of the apothecia, disc and margin, of *Aspicilia desertorum*, from Provence (France), on the thallus of *A. calcarea*, and from Greenland, on the thallus of *A. contorta*. In the type material, *C. werneri* grows in the thick margins of the apothecia of the holotype of *Lecanora* (*Aspicilia*) *auricularis* (Werner 1956), a heterotypic synonym of *A. desertorum* (Esnault 1985). This calcicolous *Aspicilia* is characterized by having a verrucose thallus and large, sessile apothecia, with a thick thalline margin. In the type specimen of *L. auricularis* all the asci of the host lichen examined were immature, and the ascospores

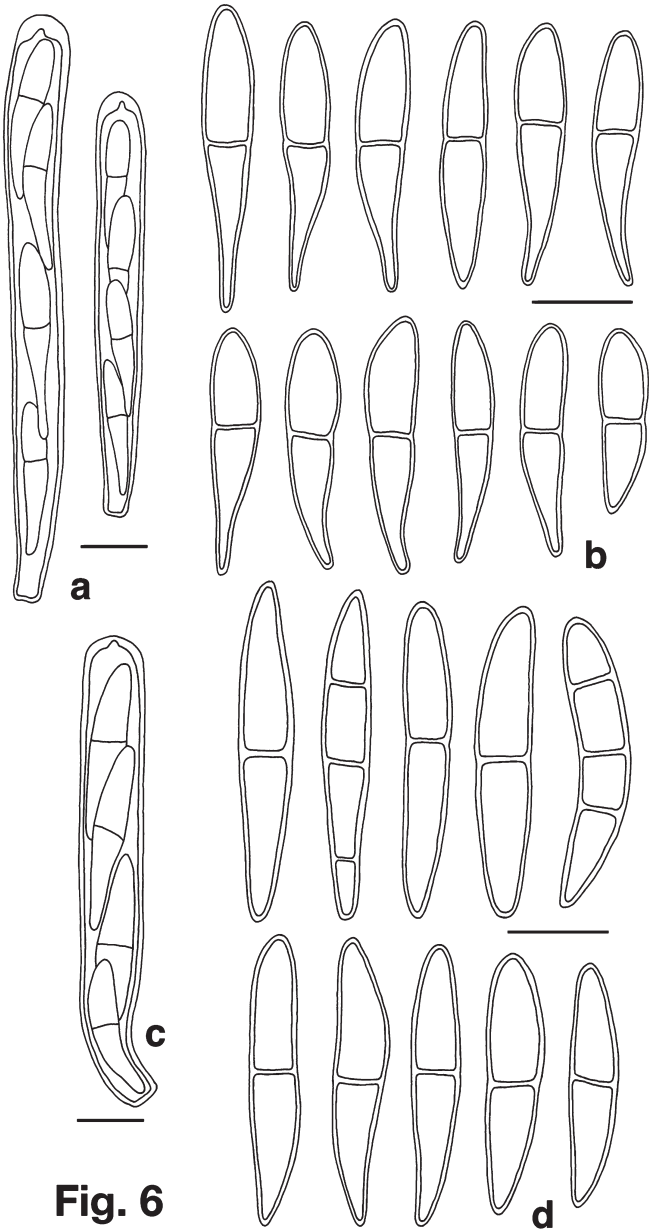

Fig. 6. *Cercidospora werneri* (a,b, holotype; c, d, Cerro de Javalambre, Aragón, Spain). a, c, asci; b, d, ascospores. All scales: 10 μm.

were lacking, as Werner (1956) already mentioned in the original description of this species. This lichen is also a vagrant species dwelling on small calcareous pebbles on basic soil. In Spain, it is restricted to a few continental mountainous areas, being fairly abundant on the top of the Javalambre mountain.

Exsiccata—none.

Additional specimens examined—**France**: Dept. Bouches-du-Rhône, Montagne Ste-Victoire, E von Aix-en-Provence, N-Abhänge SW von Vauvenargues, 500 m, Kalk, 16.V.1980, J. Hafellner 8456 (herb. Hafellner). On *A. calcarea*. – **Greenland**: W-Grönland, Disko, Umgebung von Godhavn, SW-Hänge des Skarvefjeld, NE über Godhavn, um 500 m, schrofiges Gelände, 7.VIII.1982, J. Poelt & H. Ullrich (GZU). On *A. contorta*. – **Spain**: Aragón, prov. Teruel, Camarena de la Sierra, Cerro de Javalambre, U.T.M. 30TXK6841, 2000 m, 4.VIII.1990, V. Calatayud (VAB-lich. 7597). On *A. desertorum*.

Key to the species of *Cercidospora* on species of *Megasporaceae*

1a. Ascospores simple; on *Lobothallia* spp. . . . . ***C. lobothalliae***
[Ascospores ~16–21.5 × 5–6 µm; asci ~60–80 × 12–13 µm, generally 8-spored; ascomata ~120–160 µm diam]

1b. Ascospores 1(–3)-septate; on *Aspicilia* or *Megaspora* spp. **2**

2a (1b). Ascospores ~22–31 × 5–6 µm; asci usually 4-spored . . . . . ***C. werneri***
[Ascospores largely fusiform, not to noticeably heteropolar, with a somewhat attenuated, frequently slightly curved lower cell; asci 70–100 × 8–11 µm; ascomata 150–260 µm diam; on *Aspicilia calcarea*, *A. contorta, A. desertorum.*]

2b. Ascospores predominantly smaller; asci usually 6–8-spored. **3**

3a (2b). Ascospores sole-shaped . . . . . ***C. solearispora***
[Ascospores ~17–21 × 5–6 µm, markedly heteropolar with the lower cell < 1/3 overall length; asci 50–70 × 10–15 µm, 8-spored; ascomata 160–230 µm diam; on *Aspicilia intermutans*, *A. cinerea*, *A. cupreoglauca*, sterile *Aspicilia* sp.]

3b. Ascospores not sole-shaped **4**

4a (3b). Ascospores ~18–24 × 5–7 µm; asci 70–110 × 9–13 µm, usually 6-spored; ascomata 230–350 µm diam . . . . . ***C. mutabilicola*** ined.
[Ascospores ellipsoid; asci ~6-spored; on *Megaspora verrucosa* var. *mutabilis*]

4b. Ascospores, asci, and ascomata generally smaller. **5**

5a (1b). Not cecidiogenous; on *Megaspora verrucosa* . . . . . ***C. verrucosaria***
[Ascospores ~15.5–19.5 × 5–6 µm, ellipsoid to fusiform; Asci 65–95 × 9–11 µm, elongate subcylindrical, usually 8-spored. Ascomata 130–200 µm diam.]

5b – Cecidiogenous; on *Aspicilia* spp. . . . . ***C. galligena***
[Ascospores ~14–19 × 5–6 µm, oval-ellipsoid or ellipsoid; asci 50–75 × 12–15 µm, cylindrical-clavate, usually 6–8-spored; ascomata 120–190 µm diam.]

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